इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”
Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

IS 13987-2 (1995): Methods of measurement on receiving antennas for satellite transmission, Part 2: Mechanical and environmental measurements on DBS receiving antennas [LITD 7: Audio, Video and Multimedia Systems and Equipment]

“ज्ञान से एक नये भारत का निर्माण”
Satyanarayan Gangaram Pitroda
“Invent a New India Using Knowledge”

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”
Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

IS 13987 (Part 2) : 1995
(Reaffirmed 2003)

भारतीय मानक

उपग्रह प्रसारण के लिए अभिग्राही एंटीना की मापन पद्धतियाँ

भाग 2 डोबीएस अभिग्राही एंटीना पर यांत्रिक और पर्यावरणीय

Indian Standard

METHODS OF MEASUREMENT ON RECEIVING ANTENNAS FOR SATELLITE TRANSMISSIONS

PART 2 MECHANICAL AND ENVIRONMENTAL MEASUREMENTS ON DBS RECEIVING ANTENNAS

UDC 621·396·674 : 621·396·946·621·317·39

© BIS 1995

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1995

Price Group 5

Radio Communications Sectional Committee, LTD 20

FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards on the recommendation of the Radio Communications Sectional Committee and approval of the Electronics and Telecommunication Division Council.

The object of this standard is to define the conditions and methods of mechanical and environmental measurements on receiving antennas for satellite broadcast transmissions. The Part 1 of this series covers electrical measurements on DBS receiving antennas.

The receiving antenna, together with an SHF converter, constitute an outdoor unit of a satellite receiver. Methods of measurement on SHF converter are covered in IS 13986 (Part 1) : 1994 'Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band : Part 1 Electrical measurements on DBS teener units'.

In preparing this standard, assistance has been derived from IEC Document 12 A (Sectt) 332 'Methods of measurement on receiving antennas for satellite broadcast transmissions : Part 2 Mechanical and environmental measurements on DBS receiving antennas', issued by the International Electrotechnical Commission.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

METHODS OF MEASUREMENT ON RECEIVING ANTENNAS FOR SATELLITE TRANSMISSIONS

PART 2 MECHANICAL AND ENVIRONMENTAL MEASUREMENTS ON DBS RECEIVING ANTENNAS

1 SCOPE

This Indian Standard (Part 2) covers methods of mechanical and environmental measurements on receiving antennas for satellite broadcast transmissions.

2 REFERENCES

Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 GENERAL EXPLANATION OF TERMS

The following general definitions/explanation apply for the purpose of this standard.

3.1 DBS Receiving Antenna

A DBS receiving antenna is a medium sized SHF antenna intended for use in individual and collective reception of satellite broadcast signals.

This standard mainly applies to paraboloidal reflector antennas, which include offset paraboloidal reflector antennas, Cassegrain reflector antennas, and other similar ones. However, it may also apply to planar array antennas.

A parabolic antenna usually comprises a main reflector, a primary radiator, a circular linear polarizer, an SHF converter, supporting structures for a primary radiator, pointing structures and an antenna fixture to a supporting mast. The supporting mast, however, is not included in this standard. A radome is also excluded.

3.2 Mechanical Characteristics

The characteristics concern the ability of the antenna under test to withstand mechanical forces (wind load, vibration, etc) with acceptable degradation of the electrical performance.

3.3 Environmental Characteristics

Environmental characteristics concern the durability of the antenna under test when exposed to various environments over a long period.

3.4 Wind Velocity

The wind velocity is defined as the instantaneous maximum wind velocity.

3.5 Operating Wind Velocity

Operating wind velocity is a velocity below which the electrical characteristics of the antenna under test shall not degrade by more than specified values.

3.6 Survival Wind Velocity

Survival wind velocity is a higher velocity below which the electrical characteristics of the antenna under test may degrade by more than the specified values but the electrical characteristics can be recovered by readjusting the antenna direction after the wind load is removed.

3.7 Destructive Wind Velocity

Destructive wind velocity is a very high velocity below which the electrical characteristics of the antenna under test may be permanently degraded. But, for safety reasons, no part of the antenna shall mechanically disintegrate below this specified wind velocity.

3.8 Examples of the Three Kinds of Wind Velocities

The three kinds of wind velocities are specified. Examples of the wind velocities are as follows:

Operating wind velocity	20 m/s
Survival wind velocity	40 m/s
Destructive wind velocity	60 m/s

3.9 Maximum Wind Receiving Area

The maximum wind receiving area for a device under test is the maximum projected area for the device. It does not coincide with the projected area in the direction of the applied force, but is the worst case.

4 GENERAL NOTES ON MEASUREMENTS

4.1 General Conditions

4.1.1 *Introduction*

Measurements shall be carried out in accordance with the following conditions, to ensure repeatable results.

4.1.2 *Environmental Conditions*

Unless otherwise specified, the general range of ambient atmospheric conditions for measurement are shown in Table 1.

Table 1 Environmental Conditions

Atmospheric Condition (1)	Range (2)
Temperature range	30 ± 30°C
Relative humidity	55 ± 40 percent
Air pressure	86 kPa to 1C6 kPa

4.1.3 *Number of Test Samples*

One antenna should be prepared for one test item. If an antenna has to be tested for more than two test items, the test order shall be according to IS 9000 series of standards.

4.1.4 *Stabilization Period*

A measurement should be started after the characteristics stabilization has been obtained.

4.2 Measuring Instruments

4.2.1 *Vibration Generator*

The vibration generator shall be able to generate sinusoidal vibration as well as variable vibration frequency and amplitude.

4.2.2 *Test Chamber for Thermal Test*

A thermal test chamber shall have suifficient capacity to contain the antenna and be able to maintain the chosen test temperature at any portion of the antenna within ± 2°C.

4.2.3 *Water Tank for Waterproof Test*

The water tank shall have sufficient capacity into which a primary radiator and an SHF converter can be sunk. Any air leak from devices under test in the water tank shall be able to be observed.

4.2.4 *Test Instruments for Salt Mist Test*

The following instruments are necessary for the test:

a) Test chamber,
b) Salt solution tank,
c) Atomizer,
d) Thermal controller, and
e) Humidifer.

The test chamber shall comply with the requirements given in IS 9002 (Part 12) : 1986.

The test chamber shall have a capacity that can contain the antenna under test or substitutional specimens for the antenna components. The salt mist shall flow horizontally.

Atomizer, air supply and salt solution shall comply with the requirements given in IS 9002 (Part 12) : 1986.

5 METHODS OF MEASUREMENT

5.1 Wind Load at Operating Wind Velocity

5.1.1 *Method of Measurement*

a) The antenna under test is installed to a rigid antenna test fixture, as shown in Fig. 1. The centre part of the reflector is directly supported by the fixture and the periphery of the reflector is connected to the fixture by means of springs at four points, that is, at the top, the bottom, the right, and the left. There shall be an apparatus to apply forces to a primary radiator in vertical and horizontal directions.

b) The antenna under test with its fixture is set up in a test site according to IS 13987 (Part 1) : 1994 for the measurement of antenna gain.

c) Measure the antenna gain with no wind load.

d) Apply forces W_1 and W_2 to the reflector and the primary radiator according to the procedure shown in Table 2. W_1 and W_2 are calculated from the following equations:

$$W_1 = 0{\cdot}86 \,.\, V^2 \,.\, A_1 \text{ (N)} \qquad \ldots\ldots (1)$$

$$W_2 = 0{\cdot}61 \,.\, V^2 \,.\, A_2 \text{ (N)} \qquad \ldots\ldots (2)$$

where

A_1 = maximum wind receiving area for the reflector (m^2),
A_2 = maximum wind receiving area for the primary radiator, the SHF converter and the supporting structure of the primary radiator (m^2), and
$V = V_0$: operating wind velocity (m/s).

e) Measure the antenna gain, while applying the above forces.

Table 2 Test Sequence

Sequence (1)	$W_1/4$ (2)	W_2 (3)
1	push all	downward
2	push all	sideward
3	push all	downward
4	push all	sideward

5.1.2 *Presentation of Results*

The resluts shall be listed in a table. An example of the table is shown in Table 3.

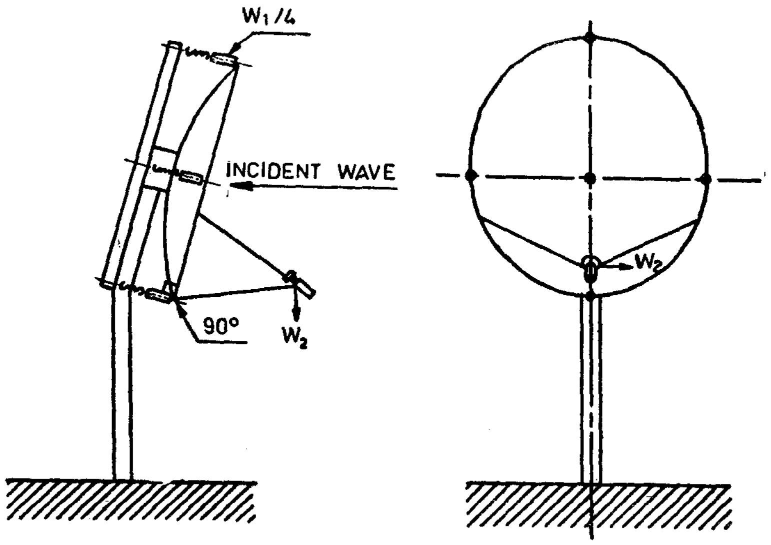


FIG. 1 OPERATING WIND VELOCITY TEST

Table 3 An Example of the List of Test Results

(*Clause* 5.1.2)

Test Item		Test Result				Remarks
		Observation	Antenna Gain Change			
			f_L	f_M	f_H	
Wind load	Operating wind velocity	—	dB	dB	dB	
	Survival wind velocity	—	dB	dB	dB	
	Destructive wind velocity	—	dB	dB	dB	
Vibration			dB	dB	dB	
Vibration at mechanical resonant frequency			dB	dB	dB	
Impact			dB	dB	dB	
Heat cycle			dB	dB	dB	
Waterproof			—	—	—	
Salt mist			dB	dB	dB	
Sulphur dioxide			dB	dB	dB	

NOTES

1 f_L, f_M and f_H are the lowest, mid and the highest frequencies respectively in the band as specified.

2 If any mechanical change is observed, it shall be described in detail in the observation column.

5.2 Wind Load at Survival Wind Velocity

NOTE — This test is not applicable to perforated mesh antennas.

5.2.1 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Install the antenna under test on a rigid antenna fixture at its centre part and position the aperture horizontally and upward as shown in Fig. 2A.

c) Put sand bags uniformly on the reflector so that W_1 is applied to the reflector. W_1 is given by equation (1). In this case

$V = V_s$ — Survival wind velocity.

d) Remove the sand bags.

e) Install the antenna as indicated in Fig. 2C and apply W_2 to the primary radiator. W_2 is given by equation (2). In this case

$V = V_s$ — Survival wind velocity.

f) Remove the force W_2.

g) Measure the antenna gain and compare it with the gain measured at (a).

h) Measure the gain of the another antenna under test.

j) Install the antenna under test on a rigid antenna fixture at its centre part and position the aperture horizontally and downward as shown in Fig. 2B

k) Make the same procedure shown from (c) to (f).

m) Measure the antenna gain and compare it with the gain measured at (h).

5.2.2 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.

5.3 Wind Load at Destructive Wind Velocity

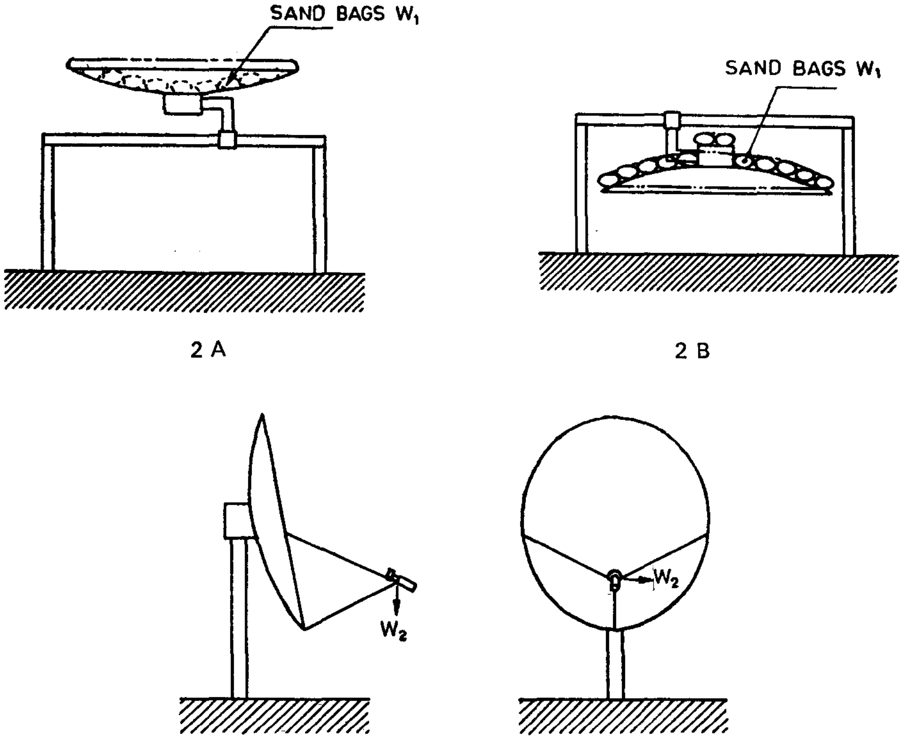
NOTE — This test is not applicable to perforated mesh type antennas.

5.3.1 *Method of Measurement*

The measurement procedure is the same as **5.2.1** except that V is Vd (Destructive wind velocity) but the gain measurement is not performed. Then observe the effects on the antenna, and note if the mechanical integrity is preserved or not.

5.3.2 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.



2 A

2 B

2 C

FIG. 2 SURVIVAL AND DESTRUCTIVE WIND VELOCITY TEST

5.4 Vibration Test

5.4.1 *Test Condition*

Test conditions are shown in Table 4.

5.4.2 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Rigidly mount the antenna under test, assembled together with its supporting structure in accordance with a fixing manual prepared by a manufacturer, to a vibration table. The antenna shall have the same configuration as when it is used for operation. The antenna supporting mast shall be as short as possible and mounted rigidly. The test equipment arrangement is shown in Fig. 3. The elevation angle of the antenna shall be the mid position of the elevation sweep.

c) Vibration shall be sequentially applied in vertical, in longitudinal and in transversal directions.

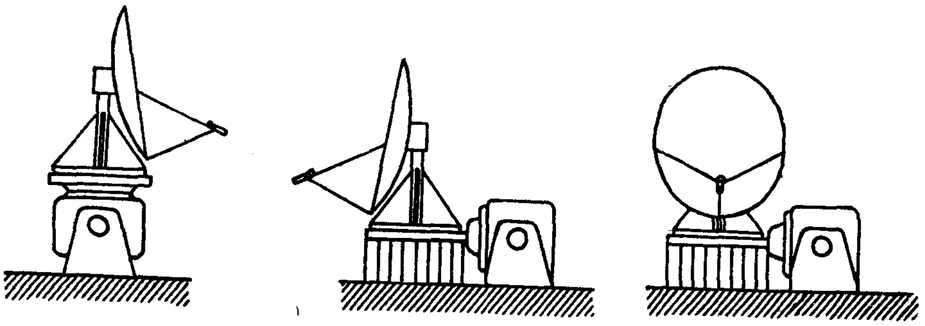
d) Visually inspect the antenna for possible mechanical changes such as loose screws, cracks or parts distortion. If no degradation is observed, detach the antenna and measure the antenna gain.

e) Compare the gain with the gain measured at (a).

NOTE — IS 9000 (Part 8) : 1981 gives useful information connected with the test.

5.4.3 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.



3A Vertical Vibration 3B Longitudinal Vibration 3C Transversal Vibration

FIG. 3 VIBRATION TEST

Table 4 Test Conditions for Vibration Test

(*Clause* 5.4.1)

Test Parameters (1)	Test Conditions (2)		
Vibration frequency range (Hz)	5-10	10-20	20-55
Amplitude (mm)	1·5	1·0	0·5
Sweep cycle (5 — 55 — 5 Hz) Sweep mode	10 minutes logarithmic or linear approximation		
Direction of vibration	Vertical, longitudinal and transversal		
Test duration	2 hours for each direction		

5.5 Durability Test at Mechanical Resonant Frequency

5.5.1 *Test Condition*

Test conditions are shown in Table 5.

Table 5 Test Conditions for Durability Test (Mechanical Resonant Frequency)

Test Parameters (1)	Test Condition (2)
Acceleration	0·5 g
Direction	Vertical, longitudinal and transversal
Test duration	20 minutes for each direction

5.5.2 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Install the antenna rigidly to the centre of the vibration table.

c) Apply the vibration vertically, and sweep the vibration frequency from 5 to 100 Hz. Acceleration shall have an amplitude of 0·5 g. The frequency should be swept slowly so that accurate measurement can be made.

d) Note the frequencies that give maximum acceleration at the following six points:

1) antenna fixture to a supporting mast,
2) primary radiator fixture to its supporting structure,
3) upper edge of the reflector,
4) lower edge of the reflector,
5) right side edge of the reflector, and
6) left side edge of the reflector.

e) Repeat (c) to (d) but in longitudinal and in transversal directions.

f) Apply the vibration according to Table 5 to the antenna at the 18 resonant frequencies obtained in (c) to (e).

g) Visually inspect the antenna for possible mechanical changes such as loose screws, cracks or parts distortion. If no degradation is observed, detach the antenna and measure the antenna gain.

h) Compare the gain with the gain measured at (a).

5.5.3 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.

5.6 Impact Test

5.6.1 *Test Conditions*

Test conditions are shown in Table 6.

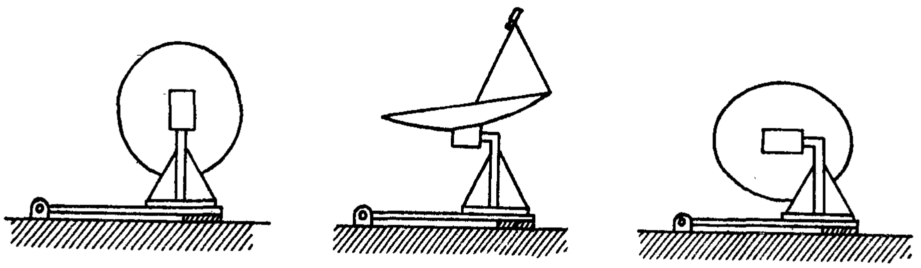
Table 6 Test Conditions for Impact Test

Test Parameters (1)	Test Conditions (2)
Acceleration	5 g
Direction	Vertical, longitudinal and transversal
Number of times	3 times for each direction

5.6.2 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Install the antenna on a rotatable wooden board, as shown in Fig. 4, which is connected to a horizontal concrete floor with a hinge at one edge. The board thickness shall be greater than 42 mm. The board length shall be greater than the maximum dimension of the reflector. The antenna shall have the same configuration as that for when it is used for operation. The antenna supporting mast shall be as short as possible and mounted rigidly. The elevation angle of the antenna shall be the mid position of the elevation sweep.



4A Vertical Impact 4B Longitudinal Impact 4C Transversal Impact

FIG. 4 IMPACT TEST

c) Measure impact acceleration by means of an acceleration meter attached near the antenna mount. Determine a lift height that gives a specified acceleration, in Table 6, to the antenna.

d) Lift the board to the lift height and release it.

e) Repeat (d). The number of times is given in Table 6.

f) If no change is observed by a visual inspection, detach the antenna and measure the antenna gain.

g) Compare the gain with the gain measured at (a).

h) Repeat (a) to (g) for other impact directions.

5.6.3 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.

5.7 Heat Cycle Test

5.7.1 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Place the antenna under test in the test chamber in the same structure as it is operating.

c) Apply the heat cycle shown in Fig. 5 continuously five times.

d) Leave it for four hours in normal temperature and humidity.

e) If no change is observed by a visual inspection, measure the antenna gain.

f) Compare the gain with the gain measured at (a).

5.7.2 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.

5.8 Waterproof Test

5.8.1 *Devices Under Test*

a) Primary radiator, and

b) SHF converter.

5.8.2 *Test Conditions*

Test conditions are shown in Table 7.

Table 7 Test Conditions for Waterproof Test

Test Parameters (1)	Test Conditions (2)
Sealed air pressure1)	19·6
Duration time in water	20 s
Water temperature	5 to 35°C

1)Additional pressure to the normal air pressure,

5.8.3 *Method of Measurement*

a) Assemble a primary radiator, the SHF converters and an air tube and sunk them in the water tank as shown in Fig. 6A or 6B.

If the output terminal of the SHF converter is coaxial type, remove a centre conductor of the coaxial connector in order to make a hole for air supply conductor.

b) Apply the air pressure and observe an air leak from the devices under test.

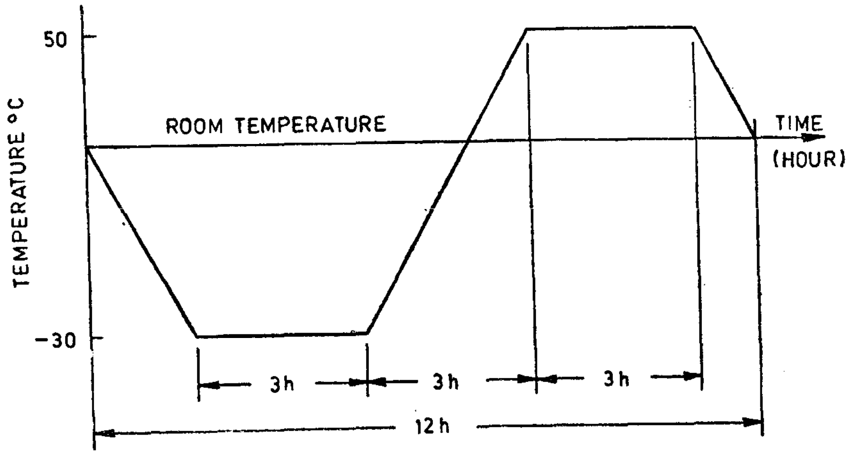
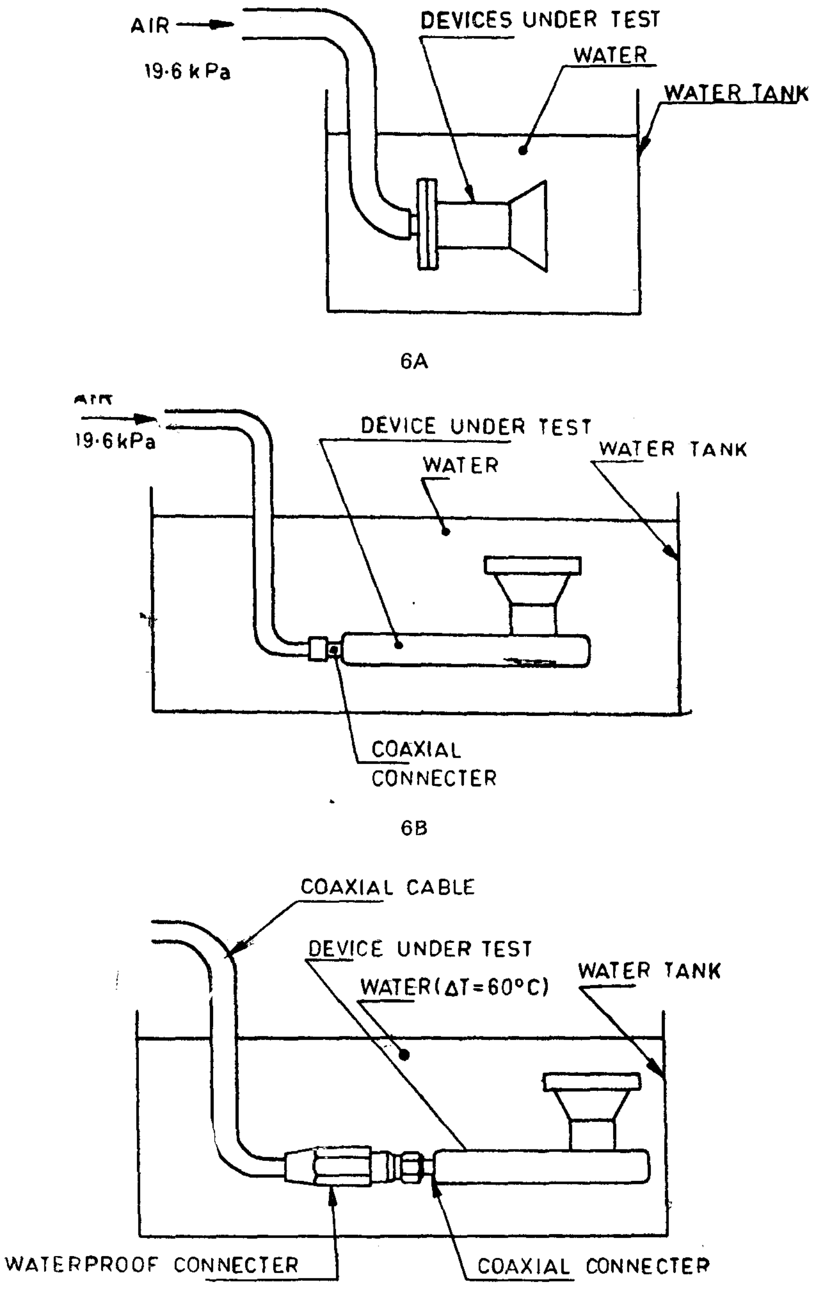


Fig. 5 Heat Cycle Diagram

If the air pressure cannot be applied to the devices, the water temperature shall be raised 60°C from the ambient temperature so that the air pressure becomes the specified pressure indicated in Table 7. In this case, a waterproof connector with cable shall be connected to the converter as shown in Fig. 6C. It requires a certain time to raise the temperature inside the converter, therefore, a preliminary test for the temperature rise should be performed.

5.8.4 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.



6A

6B

6C

FIG. 6 WATERPROOF TEST

5.9 Salt Mist Test

5.9.1 *Devices Under Test*

a) Reflector,

b) Primary radiator,

c) Supporting structures for the primary radiator,

d) Pointing structure, and

e) SHF converter.

When tests are carried out on devices and specimens, flanges of (b) and (e) shall be sealed, and specimens shall be cut out of the devices (a), (c), and (d). Cut sections shall be sealed in order to prevent water penetration.

5.9.2 *Test Condition*

Test conditions are shown in Table 8.

Table 8 Test Conditions

Test Parameters (1)	Test Condition (2)
Temperature	35 ± 2°C
Relative humidity	90 to 95 percent

5.9.3 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Set up the antenna or the test pieces in the test chamber.

c) The antenna under test is placed in the chamber in the same structure as it is operating. The aperture of the antenna shall face the salt mist stream. If the test chamber does not have enough capacity to contain the antenna under test, the specimens and (b) and (e) in **5.9.1** are suspended in the main stream of the salt mist in the test chamber.

d) Apply the salt mist to the devices under test continuously for 2 hours and leave them under the test conditions given in Table 8 for 7 days.

e) Repeat (d) 4 times.

f) Attached salt on the devices under test is washed away carefully with normal temperature water. Otherwise, it may be swept with a soft brush.

g) If no change is observed by a visual inspection, assemble the antenna and the antenna gain shall be measured. If specimens are tested instead of antenna parts, the antenna shall be assembled with new parts.

h) Compare the gain with the gain measured at (a).

j) Change the antenna direction and face the back side of the antenna of the salt mist stream, and repeat (b) to (h).

NOTE — IS 9000 (Part 11) : 1983 gives useful information connected with the test.

5.9.4 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.

5.10 Sulphur Dioxide Test

5.10.1 *Test Conditions*

Test conditions are shown in Table 9.

Table 9 Test Conditions for SO_2 Test

Test Parameters (1)	Test Conditions (2)
SO_2	20 ± 5 ppm
Temperature	40 ± 1°C
Relative humidity	75 ± 5 percent

5.10.2 *Devices Under Test*

a) Reflector,

b) Primary radiator,

c) Supporting structures for the primary radiator,

d) Pointing structure, and

e) SHF converter.

Specimens can take the place of (a), (c) and (d). The specimens shall be cut out of the devices under test.

5.10.3 *Method of Measurement*

a) Measure the gain of the antenna under test.

b) Set up the antenna or the specimens in the test chamber.

c) The antenna under test is placed in the chamber in the same structure as it is operating. If the test chamber does not have enough capacity to contain the antenna under test, the specimens, and (b) and (e) in **5.10.2** are suspended in the test chamber.

d) Test duration shall be 21 days in the atmosphere specified in **5.10.1**.

e) If no change is observed by a visual inspection, assemble the antenna and the antenna gain shall be measured. If specimens are tested instead of antenna parts, the antenna shall be assembled with new parts.

5.10.4 *Presentation of Results*

The results shall be listed in a table. An example of the table is shown in **5.1.2**.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
9000 (Part 8) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 8 Vibration (sinusoidal) test
9000 (Part 11) : 1993	Basic environmental testing procedures for electronic and electrical items : Part 11 Salt mist test
9002 (Part 12) : 1986	Equipment for environmental testing procedures for electronic and electrical items : Part 12 Salt mist/fine mist chamber
13987 (Part 1) : 1994	Methods of measurement on receiving antennas for satellite broadcast transmission : Part 1 Electrical measurement on DBS receiving antennas

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmoious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Addition'.

This Indian Standard has been developed from Doc : No. LTD 20 (1738).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75
Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VIII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 84 99, 37 85 61 37 86 26, 37 86 62
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43, 60 20 25,
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	632 92 95, 632 78 58 632 78 91, 632 78 92

Branch : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD, GUWAHATI. HYDERABAD. JAIPUR. KANPUR LUCKNOW. PATNA. THIRUVANANTHPURAM.

Printed at Printwell Printers, Aligarh, India